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ABSTRACT

A detailed and condensed discussion describes the process of test item preparation in general, with special application to the measurement of learning in occupational education. Because the Instructional Support System Occupational Education (ISSOE) has as a policy a emphasis on input from teachers, these guidelines have been prepared to assist teachers to contribute high quality test items and assessment procedures. The first phase in the process is the statement of behavioral objectives in the four domains: cognitive, psychomotor, perceptual, and affective. Examples of various kinds of test items are given and discussed, and matched to objectives classified under knowing and understanding, doing (including both psychomotor and perceptual tasks), and being (affective). Suggestions or rules are given for constructing items that will match the stated objectives, including rules for multiple-choice, true-false, matching, completion, short answer and essay questions. Performance measures are also described, together with scoring methods. Identification tasks are discussed. Suggestions are made for measures in the affective domain. Finally, procedures are given for assessing the assessment, including a checklist for that purpose. (CT,)

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INSTRUCTIONAL SUPPORT SYSTEM-OCCUPATIONAL EDUCATION II

ISSOE TEACHER ASSESSMENT GUIDELINES

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THEODORE ABRAMSON
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OCCUPATIONAL EDUCATION II

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in cooperation with the
Division of Occupational Education Instruction
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INTRODUCTION

The ISSOE program was developed based on the premise that teachers of vocational education are a valid source of instructional objectives and curriculum content. Past curriculum development projects have usually excluded teachers as their major source of input in the development process except on a very limited and carefully screened sample basis. As a result ultimate acceptance of "new" curriculum by teachers in terms of implementing changes in their classroom procedures and practices have been infrequent or non-existent. Curriculum manuals and guidelines that have been "on the shelves" have not altered instructional practices or student learning outcomes. Teacher practices and expectations for students remain the same as they were before the curriculum was developed. ISSOE materials on the other hand, are statements of expected student outcomes exclusively developed and/or adapted by teachers and are based on a consensus arrived at by teachers. ISSOE operates on the belief that student outcomes (curriculum products) are a direct function of what teachers actually <u>do</u> in their classrooms. The ultimate statements of major instructional objectives are developed through the process of teacher articulation first of the major areas (units) within a curricular area, and then of the specific goals within units (modules) and their accompanying tasks (major objectives). In developing the major objectives in the system, teachers depend on their experience, curriculum guides, task lists, industry standards, state and local codes and a variety of other sources.

The behavioral objectives key to each of the ISSOE content areas have been decided; the pedagogic route to goal achievement has been carefully

mapped out. Another step in the process of curriculum building requires the ISSOE teacher to develop tests to measure the student's ability in terms of each major objective. Measurement is an integral part of any instructional program. In addition to informing both students and teachers of , if, and when instructional goals have been reached, measurement instruments can be employed to:

1. provide feedback to students which may serve to motivate and maintain positive work and school attitudes.
2. facilitate instruction by providing teachers with information concerning student performance which may indicate a need for instructional modification and/or serve as a reflection of the strength of instruction.
3. provide information and data for future planning and program evaluation.

Reports from the field indicate that a set of guidelines describing procedures in test construction and providing examples of tests and test items would be very helpful to the ISSOE teachers. The aim of the "Guidelines" is to meet the stated needs of the ISSOE teachers by assisting them in the development of appropriate tests and test-items. This document will discuss three major topics:

1. domains of behaviors of ISSOE objectives
2. types of test items appropriate for measuring the domains of behavior
3. specific guidelines for constructing various types of test items

Suggested Use

As the ISSOE program has a wide geographical range, and in keeping with the teacher-oriented philosophy of ISSOE, it is suggested that the initial step in the development of measurement instruments for teachers within each

district, after familiarizing themselves with this handbook, is to decide upon those objectives for which they will assume the responsibility of test construction. Once these assignments have been made, group meetings held within each district should focus upon evaluation of test items, with feedback being provided by other teachers and the regional coordinator.

Paralleling the ISSOE format, the major objective of this handbook concerning the task of constructing assessments is:

> Starting with a set of ISSOE materials and a handbook of procedures of test/assessment construction, the ISSOE teacher within each district will develop and/or modify assessments for a minimum of five objectives to the satisfaction of his peers and regional coordinator as evidenced in the completion of the checklist of test-construction procedures with a rating of 6, 7, or 8 (see Checklist Use section, page 36).

DOMAINS OF BEHAVIORS OF ISSOE OBJECTIVES

The objectives stated in the ISSOE programs describe a myriad of behaviors that the student will do: For example:

- °install the various types of wood flooring
- °select the correct tools, materials, equipment and blend one bag of mortar
- °list 10 safety and shop behavior rules
- °list 6 common food-borne diseases, name all conditions which cause each disease, and describe standard procedures for prevention of each disease.

It is the measurement of these behaviors and many others which constitute an important instructional goal. The above examples of behavioral

objectives require that the student "install," "select," "blend," "list," "name," and "describe." Many of these behaviors are clearly quite distinct from one another, calling for different skills, and their assessment requires diverse measurement techniques. For example, if the intent were to assess the student's ability to "install the various types of wood flooring," it is doubtful that attainment of this goal would be evaluated solely by having the student list the steps involved in floor installation. Listing, naming, matching, describing, are not the same as installing, constructing, preparing, typing, which are further distinguishable from listening, locating, and determining.

The first step, then, in the development of assessments for ISSOE objectives, is to determine the broad class of behaviors in which the to-be measured objective belongs. Through the work of a number of educational researchers, a system of categorization has been developed which can be drawn upon to calssify behavioral objectives. The types of behaviors expected of students in vocational programs and the skills inherent in the stated objectives in the ISSOE system fall into the following four categories or domains:

1. COGNITIVE: Objectives which deal with the recall of knowledge and the development of "intellectual abilities and skills" (Bloom, et al., 1956, p. 7).

2. PSYCHOMOTOR: Objectives concerning motor skills, use of materials and objects, and behaviors which require neuromuscular coordination (Simpson, 1966).

3. PERCEPTUAL: Objectives which require the student to respond with his senses (Moore, 1970).

4. AFFECTIVE: Objectives involving a student's social/personal development (Krathwohl, Bloom, and Masia, 1964).

Here are a few examples, taken from ISSOE materials, of the types of objectives which would fall within each of the above domains. These objectives are not being endorsed as perfect - they are subject to modification and improvement, as in all ISSOE materials .

1. Cognitive:

   a. Given written word problems related to merchandising operations which involve the use of fractions, decimals, and percentages, the student will complete 75% of the problems accurately.

   b. The student will list all general rules and procedures used in the carpentry shop.

   c. The student will state the differences between a nutritious diet and a diet made up of junk foods.

2. Psychomotor:

   a. The student will select and prepare one soup from each of the four soup categories according to the standards set by the instructor.

   b. The student will select tools, equipment and materials and will cut, fit, and apply one type of shingle, plumb, level, and fastened according to manufacturer's specifications.

   c. Given a product and appropriate materials, the student will prepare a sketch of a proposed display.

3. Perceptual:

   a. After listening to a list of ten sales items the student will select those items from a written list of 15 items with at least 80% accuracy.

   b. The student will identify and select a standard menu, a flyer or stationery menu to the satisfaction of the instructor.

   c. The student will identify three or four types of cornices, identify cornice members for each type selected, and identify five cornice materials used in cornice construction within instructor's specified time.

4. Affective:

   a. Given three of their weakest traits in each interpersonal area, the student will:
      1. develop a plan of action (with instructor's aid)
      2. act on it
      3. assess their improvement in each trait by means of the Personality Assessment Instrument

   b. Given a particular store and position and clothing list, the student will select the appropriate attire. The student will evaluate himself from a checklist on personal grooming.

These four domains have been simplified by Erikson and Wentling (1976). The cognitive domain may be thought to contain all those objectives which deal with "knowing" and "understanding"; the psychomotor and perceptual domains include objectives concerned with "doing"; and the affective domain subsumes objectives which describe states of "being". A useful procedure for the teacher to use in constructing an assessment is to decide whether the intent of an objective is that a student know or understand, do or feel. Below are listed some of the infinitives which serve as indicators of the behavior domain to which an objective belongs.

Knowing/Understanding	Doing		Being
Cognitive	Psychomotor	Perceptual	Affective
to identify	to install	to identify	to follow directions
to recognize	to plate	to hear	willingness to
to estimate	to construct	to smell	select, volunteer
to infer	to fit	to distinguish	to assist
to choose	to type	to discriminate	to revise behaviors
to compare	to perform	to choose	to be rated in terms
to list	to draw	to feel	of : ethics
to analyze	to mix		integrity
to write	to demonstrate		maturity
to judge	to blend		
to appraise	to cut		
to decide	to clean		
to plan	to store		

Although many objectives can be placed in one of the four categories, there is often an overlap because of the complexity of behaviors inherent in the tasks a vocational education student is expected to master. For instance, consider an objective which requires the student to cut, fit and apply a shingle. This is predominately a psychomotor/doing objective; however, in order to achieve the goal stated in this objective, the student must know the procedures involved in shingle application (cognitive domain);must be aware of placement of the shingle and goodness of fit (perceptual) and must demonstrate a good attitude as reflected in his work habits (affective domain). The essential point is that the teacher must decide upon the crucial behavior and measure it. The major focus of the objective will furnish clues as to what form the measurement should take.

Exercise 1. CLASSIFICATION OF OBJECTIVES

Below are listed objectives taken from various ISSOE program descriptions. Try to determine under which of the four domains each of them can best be classified. Write the domain (cognitive; perceptual; psychomotor; affective) in the blank space provided next to each objective:

_____ 1. Given tools and materials, the student will install all types of pre-fab kitchen and bathroom cabinets.

_____ 2. The student will select the correct conductor type and size for the residence in accordance with NEC and local code standards.

_____ 3. Given a personal inventory instrument, the student will assess and evaluate each trait.

_____ 4. Given an operational cash register, the student will demonstrate in a role-playing situation, an exchange and/or refund.

_____ 5. The student will list examples of special promotional and institutional events that promote a store's merchandise, services, and/or company image.

_____ 6. The student will select the proper tools and materials and will construct an 8" block return corner according to field standards of quality.

_____ 7. The student will design a regular, soft, and liquid and diabetic diet to the satisfaction of the instructor.

_____ 8. The student will select supplies and weigh all ingredients in a given recipe.

_____ 9. The student will identify four types of vermin and list safe methods of control for each to meet health department standards.

(Answers on p. 40)

Once an objective has been classified, the general form of its assessment can more readily be decided. A simple guide showing the types of approaches that may be used for each domain is presented below. (The chart is meant as a guide, not a prescription)

DOMAIN OF OBJECTIVE	FORM OF MEASUREMENT INSTRUMENT
cognitive	paper and pencil
psychomotor	performance tests
perceptual	performance and paper and pencil tests
affective	questionnaires, inventories, rating scales, and logs and charts

TYPES OF TEST ITEMS

Before describing the measurement approaches specific to the domains of learning, a further way of classifying and describing objectives will be detailed. Each ISSOE objective was to have been written so that it could be assessed in an "objective" manner. That is, the assessment devices were to state the student behaviors required and the scoring procedures and criteria so that any rater would arrive at the same conclusion concerning student performance. In the ISSOE system student performance was to be assessed through test items that are performance-based and replicate as closely as possible the tasks that exist in the real world of work.

Consider the following:

> Given a car with coil springs, a jack, jack stands, and the proper hand tools, the student will remove and replace coil spring and complete the task according to manufacturer's specifications and in twice the flat rate time. (automotive)
>
> The student will ready the tape recording machine for operation, record selected sentences and paragraphs, and close out the recording with 100% accuracy in procedure. (office practices)

In the above examples a student who removes and replaces a coil spring according to manufacturer's specifications in twice the flat rate time and a student reading and recording information with 100% accuracy in procedure are said to have satisfied the objective. These students do not receive an "A" in coil springs or recording. Rather, both they and the instructors know further instruction is not necessary, and the student is felt to "have" the skills mentioned.

As teachers venture toward the construction of a criterion-referenced measurement, acute sensitivity to the statement of objectives is necessary. As in the previous section, attention to the main intent is important (what the student will do) as well as information concerning the conditions under which the performance will be measured. The goal is to match intents and conditions to test items. If these components of the objectives and

the test do not support one another, then it will be difficult to assess whether or not the student has achieved the objective.

Here are some examples of matched and mismatched objectives and items. An item which fits will reflect the performance, intent, and conditions of the objective. An inappropriately constructed item will not measure the task described by the objective. As stated earlier, objectives have been taken from ISSOE materials and are subject to modification.

1) obj.---The student will state the differences between a nutritious diet and a diet made up of junk food.

   item---Categorize the following foods as a component of either a nutritious or junk food diet. Describe the strengths and weaknesses of each type of diet with respect to calories.

   This item fits: Knowing differences between diets is to be tested through categorization of foods and a comparative analysis of the two diets.

2) obj.---The student will be able to solve problems of addition, subtraction, and multiplication on the ten-key adding machine.

   item---Solve the arithmetic problems using the ten-key adding machine.

   Another fit: The performance feature, using the adding machine is part of the item; the intent, solving math problems is also matched; similarly, the conditions stated in the objective are carried over into the item-computations to be performed on the ten-key adding machine.

3) obj.---Given materials, the student will install non-metallic cable/ metallic cable in a residence according to the NEC and local building code.

   item---Identify the various sizes of non-metallic sheathed cable/ armoured cable used in the residence.

   Mismatch: Installing and identifying do not tap the same competencies. It cannot be assumed that the student who can identify the types of cable will also be able to install the cable.

4) obj.---Given a selection of tools used in the tile-setter's trade, the student will identify all by name within ten minutes.

item---Install a 4 1/4" x 4 1/4" ceramic tile to plus or minus of 1/16" tolerance in plumb and level.

Mismatch: Again, installing and identifying are not the same performances. If the aim of this objective is that the student know the names of all the tools, then even the proper use of the tools in an installation task will not inform the teacher of the student's knowledge of terminology.

Here are some more examples of objectives and items. Try to determine whether or not the measurement item reflects the main focus of the objective. Check the "match" space if the objective is tested by the item, and the "no-match" if it is not.

Exercise 2. MATCHING OBJECTIVES AND MEASUREMENTS

1) obj.---Given a car with a working brake system and the necessary tools and equipment, the student will remove and replace proportioning valve, bleed the system, complete the task according to manufacturers specifications, in twice the flat rate time.

item---Difficulty has been reported with this brake system. Locate the source of trouble and remedy the problem.

MATCH	NO-MATCH
_____	_____

2) obj.---Given a leaking tire, tubeless or tube type, tubeless tire plugs and necessary tools and equipment, the student will repair a leaking tire and inflate the tire to manufacturers specifications with no air leaks.

item---A customer has entered your body shop and reports a leaking tire in his/her second car which is parked 10 miles away. He/She asks you to describe the procedure for repairing the leak and asks to purchase all necessary equipment. State what you would tell the customer and list the equipment you would suggest that he/she purchase.

MATCH	NO-MATCH
_____	_____

3) obj.---Given 10 foods, the student will chart the Basic Four with 80% accuracy.

item---Check the food group to which each item of the food list below belongs.

Item	Meat/Fat	Fruit/Veg	Milk Group	Bread Group
chicken	___	___	____	____
bacon	___	___	____	____
cottage cheese	___	___	____	____

MATCH NO-MATCH

_____ _____

4) obj.---The student will increase and decrease a recipe by completing at least three written recipe problems.

item---The following recipe for holiday punch will provide 20 servings. Locate all necessary ingredients for this punch from the supply room and prepare holiday punch for 35.

MATCH NO-MATCH

_____ _____

5) obj.---Given specified basic hand tools and block samples, the student will identify the name and the major use of each with 100% accuracy on a written test within the specified time as set by the instructor.

item---On the table at the front of the room are displayed a numbered series of masonry tools and samples of block units. Name each item in the matching numbered space on your answer sheet and describe the major function of each.

MATCH NO-MATCH

_____ _____

6) obj.---Given 10 lines of typewritten material with 30 words to be capitalized, the student will make all necessary corrections with at least 85% accuracy within 7 minutes.

item---Transcribe the following memo from the taped copy making sure to capitalize wherever necessary.

MATCH NO-MATCH

_____ _____

check your answers on pg. 41.

GUIDELINES FOR TEST CONSTRUCTION

Now an introduction to the realm of measurement is complete: objectives have been clearly stated; the major domain in which each objective falls has

been determined; and the need for matching measurement to objective has been realized. Explanations and examp es of the many forms of assessment within the domains of learning will follow.

Cognitive Domain

In constructing test items to measure cognitive objectives, the test-maker must take care to present students with questions which will allow for their optimal performance and clearly reflect their level of achievement. In general, cognitive items should not be clouded by inappropriate vocabulary, should not be "trick" questions, but rather should be clearly stated, direct, and the achievement being tested should be apparent. The difficulty of a test-item should be determined only by the complexity of the concept or information being tested, not by its form. Both recognition tests and constructed-reponse tests will be described. Recognition items offer the student alternative responses to questions or open-ended statements (multiple choice; true/false; matching). Constructed response items require the student to recall specific information required to complete a phrase or to elaborate, in a written form, upon a problem. (short answer, essay).

Through a series of examples, the advantages and disadvantages of the various forms of test items together with inidcators of "good" vs. faulty" items will be described.

Multiple Choice

A multiple choice item is composed of a stem statement (the question) and is followed by a list of 4 stem completors or responses of which only one choice is correct. The remaining response alternatives are referred to as "distractors." The multiple choice item can be used in a variety of ways: testing knowledge; testing understanding; testing problem-solving capabilities.

The following examples* reflect these three facets of cognition.

a. Knowledge

*One ounce of ground black pepper equals how many tablespoons?

a. 2
b. 5
c. 16
d. 20

b. Understanding

A customer complaint about an erroneous charge on his/her statement should be filed under:

a. sales
b. services
c. accounting
d. purchasing

c. Application

During a "20% off" sales, an item originally costing $32.00 will now cost:

a. $30.00
b. $28.20
c. $25.60
d. $24.80

The multiple choice item can also assume different stem forms. These include the direct question and incomplete sentence.

The direct question is easily constructed by simply asking the desired question followed by a list of possible answers.

DIRECT QUESTION:

In what temperature range should dry storage fresh vegetables be stored?

a. 35° F-55° F
b. 45° F-65° F
c. 55° F-75° F
d. 65° F-85° F

*sample test item developed by the University of the State of New York The State Education Department Albany, New York 12224

As an incomplete sentence stem, the same knowledge can be tested:

The appropriate temperature range for storing dry storage fresh vegetables is:

a. 35° F - 55° F
b. 45° F - 65° F
c. 55° F - 75° F
d. 65° F - 85° F

When constructing a multiple choice item or test, the rules listed below are followed.

1. The item (stem) has a single central issue or problem.

The student should be able to figure out what is being asked before he/she searches the list of alternatives.

POOR A FROZEN vegetable should be:

a. stored at temp. between 0° F - 25°F
b. checked for firmness and breakage
c. stored immediately
d. defrosted before cooking

It is unclear from this item just what is being tested. All the alternatives are potentially correct. The intent of the item must be specified. If the temperature of storage was of interest, the following item could be presented:

IMPROVED At what temperature range should frozen foods be stored?

a. -10° F - 0° F
b. 0° F - 25° F
c. 25° F - 32° F
d. 32° F - 55° F

2. State the item clearly.

Often, difficult vocabulary or "overstuffed" sentences can have a detrimental effect on the quality of the question. By rewriting examples in simple vocabulary or by stating the problem in more than one sentence, the item can be strengthened:

POOR How many achieved unsatisfactory scores if only 64% of the job applicants of which there were a total of 150 achieved satisfactory scores?

a. 36
b. 64
c. 54
d. 48

IMPROVED Recently 150 job applicants were given a math test. Only 64% of the applicants achieved a satisfactory score. How many applicants received an unsatisfactory score?

a. 36
b. 54
c. 64
d. 96

POOR (Vocab) The use of a flour of inferior qualitative status may manifest itself in a bread product which is:

a. crumbly
b. course
c. soggy
d. pale

IMPROVED The use of a low-grade flour may result in a bread which is:

a. crumbly
b. course
c. soggy
d. pale

3) All choices must appear plausible.

A good group of alternatives is composed of responses which could be considered equally attractive to the student who has not mastered the material. Remember, a goal of criterion-referenced measurement is to discriminate between masters and non-masters. If "distractors" can be automatically eliminated through a common sense approach, the test item will not properly indicate the students knowledge as the chances for guessing the correct response will be increased.

POOR How many ribs do trimmed lamb racks for double orders have?

a. 5
b. 7
c. many
d. some

Options c and d appear somewhat frivolous, and would probably be eliminated immediately.

IMPROVED How many ribs do trimmed lamb racks for double orders have?

a. 5
b. 7
c. 9
d. 11

4) State the stem and response choices positively.

Items stated negatively can be confusing, leading the student to difficulties in interpretation. Care should be taken to state all multiple choice items in the positive.

POOR The duties of a salesperson do not include

a. not filling out sales credit sales forms
b. not signing for delivery of merchandise
c. not restocking shelves
d. not cashiering

IMPROVED The duties of a salesperson include filling out

a. sales credit forms
b. inventory sheets
c. purchase orders
d. state of delivery forms

5) Avoid extraneous clues in the test item.

Clues can have many forms:

a. keywords found in item and in only the correct choice.
b. grammatical inconsistency, for example: a singular item followed by 2 plural responses and 2 singular responses.
c. choice length: an alternative which is longer than all others is usually the correct one; make alternatives approximately equal in length.
d. "none of the above" "all of the above" Do not use these phrases when no other choice can be developed. If they are used, sprinkle them throughout a test and occasionally have them be the correct response.

for example:

POOR Which of the following handtools is used for drilling?

a. rachet screwdriver
b. ripping chisel
c. hand drill
d. power drill

POOR Which person has as his/her duty the pricing of items?

a. merchandiser
b. salespeople
c. stock clerks
d. advertiser

True/False

The true/false item is often easy to develop and the time required to complete a true/false test is usually shorter than that for a multiple choice test. However, true/false tests may result in an invalid assessment of the student's knowledge as he/she has a 50% chance of guessing the correct response. Nevertheless, by following the rules outlined below, strong true/false items and tests can be constructed.

1) Base the true/false statement on facts without exceptions or a need for qualifiers.

If students are aware of exceptions to the true/false statement, confusion may arise. It will be unclear as to whether or not the exception or need for qualification was intended to be the basis upon which an item is to be judged either true or false.

POOR T F Bacteria need moisture to live.

When bacteria form spores they do not require moisture to live. This exception to the above statement could lead to confusion.

2) The true/false item should have only one statement to be judged.

Confronted by more than one statement to be judged as either true or false, the student will most often be confused. It will be difficult for him/her to decide upon a response as either one or both of the statements within the item are either true or false.

POOR T F The overhang of a common rafter is determined by the horizontal distance that it projects from the building and the run of a common rafter is equal to 1/2 the rise.

In this item the statement about the overhang is true. However, the statement concerning the run is false. It would be difficult to assess this item as either true or false.

IMPROVED T F The overhang of a common rafter is determined by the horizontal distance that it projects from the building.

T F The run of a common rafter is equal to 1/2 the rise.

3) Avoid clues in the true/false statement.

The use of extreme words like "all, never, always," and qualifiers like "sometimes, usually, seldom, might" could tip a student off as to whether or not a statement is true.

POOR T F The baking temperature for roast veal should always be above 375°.

T F The closing of a sale should never include a last chance pitch.

T F Honey might be substituted for sugar in some cookie recipes.

General rules in constructing true/false tests include: making true and false statements approximately the same length; keeping the true/false item brief such that knowledge of the concept rather than reading ability will be tested; and incorporating approximately an equal number of true and false statements in the test.

Matching:

The third type of guided response cognitive test is the matching item. A matching item requires little reading time when compared to other items, and can be scored easily and objectively.

Usually matching items are stated in two columns: the stem and the response. For example:

*For each food, a through e listed below, select the cooking tool, chosen from the list below, to which it applies. Place the number of your choice in the space provided.

	Food		Cooking Tools
____a	Fried Chicken	(1)	2 oz. ladle
		(2)	6 oz. ladle
____b	Mashed Potatoes	(3)	No. 8 scoop
		(4)	slotted spoon
____c	Tuna fish a la king	(5)	spatula
		(6)	tongs
____d	Salmon Loaf	(7)	2 pronged fork
____e	Gravy		

This type of matching item is used to assess the student's knowledge about tool usage. Another way to test this knowledge might be to present students with an array of labeled and/or numbered tools to be matched to the column of foods to which they apply.

The following rules should be followed in constructing a matching item.

1. Members of each column should be internally related.

   If, for example, both health workers and body systems were to be matched to their function, students could easily eliminate "people" functions when attempting to match a body system to its function and similarly, eliminate "body" alternatives when working on a health/worker element of the list.

*sample test item developed by the University of the State of New York The State Education Department Albany, New York 12224

POOR *On the line at the left of each function described in column A, a-h, write the number of the term chosen from column B to which it refers.

A function	B term
__a carries oxygen and food to the body's cells	1. circulatory system
__b takes oxygen into the body and removes carbon dioxide from the body	2. ward clerk
__c responsible for directing other health personnel in their daily care of patients	3. musculo-skeletal system
__d filters liquid waste products from the blood	4. team leader
__e aids in lifting and moving patients and provides specialized care for male patients	5. head nurse
__f produces chemicals that regulate the body organs	6. respiratory system
__g provides the basic daily care for the more chronically ill patients	7. orderly
__h coordinates the entire operation of a health care unit to provide optimum patient care	8. endocrine system
	9. urinary system
	10. nurses aide
	11. digestine system

An improved version of this item would require the construction of two new items: one that requires the student to match health workers to their job duties, and a second requiring the matching of body systems to their functions.

A suggested list of elements for columns to be matched is presented below.

*Two "good" matching items developed by The University of the State of New York, The State Education Department, Division of Occupational Education Instruction have been combined to illustrate a poorly constructed item.

tools ----------uses
machines ----------uses or parts
ingredients ----------recipes
merchandise ----------departments
problems ----------solutions
foods ----------cooking temperatures
terms ----------definitions

2. Directions must be clearly stated.

3. Present more alternatives than stems.

"Process of elimination" will be avoided if two or three extra alternatives are provided. If there are 6 items, 8 responses might be used; if 8, perhaps 11 responses.

4. Keep the list relatively brief.

If 25 stems and 30 responses are to be matched, this would require a student to make 750 comparisons. A matching item should be kept to 10 or fewer elements.

5. Title the columns.

Single word descriptions of the column's content will help the student to perform the desired behavior.

Incomplete Sentence

Another method for testing recall of information and problem solving abilities is the completion item. Generally, completion items are limited to measuring knowledge of specific facts.

Below are the rules for constructing a completion item.

1. Statements should be clearly stated such that only one response is correct.

The statement should indicate without doubt what is being asked of the student.

POOR Cottage Cheese is _____.

The response could be "white", "curdled milk", "good with cantaloupe" or perhaps what the instructor intended, "a member of the milk group."

IMPROVED Of the basic four food groups, cottage cheese is a member of the _____ group.

2. Require only one completion per item.

The more blanks that appear in a statement, the less intelligible will be the question. There will be times, however, when 2 or 3 related terms are required, in which case an extended blank and a stated reference to the number of terms required is necessary. In general, completion responses should be limited to one or two words.

(new) (more) (old)

POOR _____ products need _____ advertising than _____ones.

The potential responses are abounding:

some	better	other
new	more	old
good	less	fair
dull	livlier	exciting

If the teacher's interest was in the distinctions between new and old items in terms of advertising, a better way of stating the question might be:

IMPROVED The amount of advertising for a new product, when compared with the amount for an old product is _____.

If multiple response is required of the student, it should be indicated in the item stem. Example:

Two techniques which can be used to close a sale are _____ and _____.

3. Place the blank at or near the end of the statement.

An opening blank requires the student to read through the statement and then go back to the beginning to respond.

POOR _____ are used to control excess noise from an automobile.

If the blank is at the end, all the information the student will need to respond will have been available.

IMPROVED To control excess noise from automobiles, _____ are used.

4. Watch out for clues in the statement.

   a. grammatical clues

      a an is are

   b. short blanks for short answers, two blanks for two words, long blanks for long words. Blanks should be uniform in size throughout the test.

Other Short Answer Items

In addition to the completion item described above, short answer items also take the form of a statement of definition, principle or rule, listing of procedural steps or product or machine/tool components, and identifying items.

For example:

1. Describe the purpose of a proportioning valve.
2. List five safety rules for a carpentry shop.
3. List the five elements of communication in merchandising.
4. There are 8 lettered tools on display. Next to each letter on your answer sheet, write the name of the tool.

The responses required in these examples go beyond the one or two words called for in the completion item, but do not generally assess the higher-order cognitive skills tapped by the essay question.

Essay Items

The essay item can be used when higher-order cognitive capabilities are being tested i.e., understanding, analytic skills, problem solving, and judgment. When faced with an essay question, the student must draw on his/her knowledge and experience, evaluate it in light of the question, organize the information within a framework of personal judgments, and write a response. It should not be used to assess a student's knowledge of facts which would be

better evaluated through multiple choice, true-false, matching or completion tests.

Although higher-order cognitive skills can be tested through the essay item, it is difficult as well as time-consuming to score. The essay item is also limited in the content which it tests. However, the essay item can 1) give the teacher insight into a student's higher-level cognitive abilities; and 2) afford the student the opportunity to express his/her thoughts on an issue or a problem.

Below are the procedures to follow in the construction of an essay item.

1. Be specific.

   An essay item should not require the student to write all that he knows about a topic. The item should have focus. For example, consider the "poor" item below:

   POOR In an extensive reponse, explain the workings of closing a sale.

   As is, this item requires a procedural outline of paperwork and a description of the possible sales closing ploys. All of this information could be obtained through more objective tests. An improvement might be:

   IMPROVED Discuss five tactics for closing a sale. Describe one advantage and disadvantage of each tactic and the type of customer with whom each method might be successful. Justify all responses.

   The improved item focuses on "salesmanship" and aims to tap the student's understanding of the social subtleties involved in closing a sale. A combination of fact, analysis, and judgment is required to respond to this item.

   The point is, tell the student exactly the type of information that is expected to be included in the answer.

2. Let students know the approximate time to be spent or point value of an essay item.

   On the printed test sheet indicate a time limit or a point value

so that students will be able to budget their time appropriately, and be aware of the relative importance of each question or part of a question.

For example:

> The phone rings in the reception area of the Central Communication Corporation. (total: 25 points)
>
> a) Describe the procedure that the receptionist will take in screening the call. (10 points)
>
> b) The caller is rude, will not answer questions, and loudly demands to speak with the president of the corporation. Discuss your method for handling this type of problem. (15 points)

3. Decide upon acceptable answers before the test is given.

If the test-maker outlines the potential responses he/she hopes to see from students, not only will he/she have an idea about the required time for responding, but the crucial points listed, discussed, and/or described will serve as a guide in the difficult task of scoring an essay item.

Performance Measures: Psychomotor and Perceptual Domains

Work Samples

Measures of performance which test "doing" objectives are of crucial importance in vocational education. Beyond the cognitive assessments of a student's "understanding," performance measures indicate how well a student can do a task. A performance measure includes a step by step observation and evaluation of either the student's procedures in doing a task (process evaluation), the quality of the student's product as a result of his procedural performance (product evaluation), or combination of both process and product evaluation.

Both process and product-oriented measures of performance can be evaluated through the use of checklists and rating scales. Before detailing the variations in scoring procedures, examples of process and product objectives will be listed.

Process	Product
Casing tools	Preparing food
Operating machines	Constructing a deck frame
Conducting a sale	Typing a letter
Filing	Mixing cement

In many cases however, both the process and product are of equal importance. Consider, for example, an objective which concerns baking a loaf of bread. In order to determine whether or not a student has mastered the skill of bread-baking, both his/her procedures and the bread should be evaluated. Similarly, if a student is required to type a letter, by only rating the quality of the typed page (product) it will be difficult to determine strengths or weaknesses in student's typing skills (process). In most cases, both process and product

will be of interest. Imagine a student applying shingles to a roof. The student has followed all safety rules, handled tools appropriately, but the shingles are unevenly applied.

The steps to be taken in constructing a performance test are listed below.

1. Conduct a job/task analysis

   List all the steps which the student is expected to follow in performing the job. List all the characteristics of the product to be evaluated.

2. List all equipment and materials

3. Decide which steps and/or qualities of the product are to be assessed

   This decision will enable the teacher to construct the appropriate scoring device. The list of points to be assessed and equipment involved will be useful in repeating the test for different students and will make it possible for the test to be administered by another instructor.

4. Develop a scoring guide

Developing a scoring system

There are many ways to quantify a student's performance in a work sample situation. The simplest way is to use a checklist. After having listed all of the behaviors expected of a student and/or qualities of a product, a check in the appropriate space would indicate that the student or product met the criterion for that step or characteristic. For example, consider the rating of a student's ability to weld and braze ferrous and nonferrous metals in flat and horizontal positions:

In examining student performance, check the OCCURRENCE space for each applicable PROCESS or PRODUCT item listed below:

*PROCESS	OCCURRENCE
a. Demonstrated knowledgeable ability in following directions	_____
b. Properly assembled parts as outlined or directed by instructor	_____
c. Correctly set welding current and/or pressures	_____
d. Maintained correct electrode or torch angles	_____
e. Possessed excellent coordination of mind and hands	_____
f. Observed the desired safety factors - personal and equipment	_____
g. Performed desired operator maintenance of equipment - care, etc.	_____
h. Time consumed completing test: Check <u>one</u> statement only	
(1) Finished sooner than allotted time	_____
(2) Finished within the allotted time	_____
PRODUCT	
a. CAST IRON WELDING	
(1) Good fusion?	_____
(2) Good penetration?	_____
(3) Bead uniform?	_____
(4) Free of undercut?	_____
(5) Free of overlap?	_____
(6) Free of checks or cracks?	_____
(7) Free of holes or voids?	_____
(8) Good crown on weld face?	_____
b. CAST IRON BRAZING	
(1) Bead uniform?	_____
(2) Brass pulled much cast iron?	_____

* adapted from Boyd, J.L. and Shimberg, B. <u>Handbook of Performance testing</u>: A practical guide for testmakers. Educational Testing Services Princeton, N.J. January 1971, 113-114

PRODUCT	OCCURRENCE
(3) Evidence of good tinning?	_____
(4) Free of overlap?	_____
(5) Free of any "burned" metals?	_____
(6) Free of runs over side?	_____
(7) Free of holes or voids?	_____
(8) Good crown on weld face?	_____
c. MILD STEEL BRAZING	
(1) Bead uniform?	_____
(2) Evidence of good tinning?	_____
(3) Free of excessive "flowing"?	_____
(4) Free of any "burned" metal?	_____
(5) Free of holes or voids?	_____
(6) Good crown on weld face?	_____
d. DISSIMILAR METAL BRAZING	
(1) Bead uniform?	_____
(2) Evidence of good tinning?	_____
(3) Free of excessive "flowing"?	_____
(4) Free of any "burned" metal?	_____
(5) Free of holes or voids?	_____
(6) Good crown on weld face?	_____
e. SILVER SOLDERING	
(1) Bead uniform?	_____
(2) Free of excessive "flowing"?	_____
(3) Evidence of good tinning?	_____
(4) Free of excessive warpage?	_____
(5) Free of wasted filler metal?	_____

The same checklist could be constructed using a "yes" - "no" format.

For example:	Yes	No
Maintained correct electrode or torch angles	___	___

If point value is to be assigned to each of the process steps or product characteristics a space for credit earned can be built into the checklists.

For example, the teacher might want to evaluate a student's plating of food items on a 1 - 5 scale, 1 being poor and 5 being excellent.

	Poor	Inadequate	Fair	Good	Excellent
	1	2	3	4	5
Student plates food items appropriately					

This system of assessment will allow both the teacher and student to pinpoint strengths and weaknesses, in either process or product.

Another use of a numerical rating scale involves the use of bipolar adjectives. For example:

Food item characteristics (product)

a. Appearance

Dull Shiny

___ ___ ___ ___ ___

1 2 3 4 5

b. Texture

Thin Thick

___ ___ ___ ___ ___

1 2 3 4 5

or

Coarse Smooth

___ ___ ___ ___ ___

1 2 3 4 5

Food item preparation (process)

a. Personal hygiene

Unhygienic Hygienic

___ ___ ___ ___ ___

1 2 3 4 5

b. Measurement of ingredients

Inaccurate Accurate

___ ___ ___ ___ ___

1 2 3 4 5

When using a numerical rating scale it is a good idea to decide on the minimum score necessary for the student to achieve in order to be considered a "master."

A verbal rating scale may also be constructed. In using this type

of scale, the teacher simply checks or circles the appropriate process or product description. For example, in evaluating the crust of a yeast bread:

Crust:

Cracked	/ Minimal cracks	/ Uniform uncracked

Identification Tests

The above procedures are followed when using an actual performance or simulated performance set-up within the psycho-motor domain. There are however, performance tests which fall into the perceptual domain. These are identification tests. One form of this test has been described previously (identifying tools, parts, foods, etc., from an array). This type of identification requires visual skills.

Other perceptual skills can also be assessed through identification tests. For example, auditory skills may be assessed by presenting students of automotive mechanics with a series of tape recorded engine sounds and asking the students to identify the manufacturer of or problems with the car.

Similarly, presenting students with a series of foods to taste and asking them to identify the food with, for example, the proper amount of salt would appear to be a useful skill to assess in the beginning cook. In addition, students in the foods area might be asked to identify certain odors using their sense of smell. In many of the areas which require the student to work with tools, machinery, and equipment which may require adjustment, a test of the students' touch skills can be performed through asking students to evaluate a series of equipment with various degrees

of maladjustment.

In constructing an identification test of perceptual skills, the suggestions below should be followed.

1. State directions clearly.

   If the teacher wants tht student to identify all smells, sounds, or things felt, this should be stated. If, however, the student is to select one of the choices make it clear to him/her. Tell the student what he or she is to look for.

2. Present only a few choices from which discriminations are to be made.

   If the item requires the student to indicate which one of a group represents a certain thing, give only four to five options. If the number of alternatives is excessive, some of the earlier perceptual experiences may be forgotten.

3. Present options which really require discrimination skills.

   If common sense options are offered, chances of guessing correctly are increased and the usefulness of the assessment is decreased. For example:

   You will hear the sounds of five different engines. Place a check next to the number which represents the sound of a Ford engine.

   Sounds

   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

If sounds 2 and 4 were respectively those of an electric train and a food processer, and only 1, 3 and 5 were engine sounds, the item would be markedly simplified.

Affective Domain

The measurement of attitudes, opinions, feelings and interests fall within the affective domain. The forms of assessment to be described in this section are those which are or are likely to be ISSOE major objectives. For example, the assessment of :

- salesmanship
- interpersonal job relations
- attitudes toward safety
- attitudes toward sanitary procedures

These forms of affective behavior, as well as others stated throughout the ISSOE materials can best be measured through direct observation or unobtrusive observation.

There are often occasions in education programs where interests within an area, feelings about a class instructor or project are of interest. Gathering data that describe either student traits and characteristics or reactions to program aspects results in global assessment which can be used in either determining placement for a student or quality of instruction. However, in the ISSOE system, only those affection domain objectives are to be measured that deal with the students overt behavior indicative of the attainment of that objective.

Through direct observation, that is, watching the student at work, the behaviors of interest can be recorded. Unobtrusive observation can employ similar rating techniques, the difference being that assessments

are made following rather than during observation of performance. The use of unobtrusive measures is beneficial when the instructor feels that direct observation will have a negative effect on students performance or will result in a student performing only for the rater. Scales which can be used parallel those described in the performance section.

For example, consider the following checklist:

Place a check (✓) next to observed behavior

_____ greets customer in friendly way
_____ offers assistance
_____ describes features of item
_____ suggests higher priced model
_____ compares benefits of each
_____ allows customer room for own decision

Similarly a checklist or yes/no check could be used to assess students' safety and sanitary procedures. Numerical scales could also be used. For example, in rating a receptionist's affective behavior consider this partial rating scale for a role-playing objective:

Activity	Rating				
	Poor				Excellent
1. Greets client pleasantly	1	2	3	4	5
2. Offers assistance	1	2	3	4	5
3. Maintains eye contact	1	2	3	4	5
4. Answers clients questions	1	2	3	4	5
5. Reaction to interruptions	1	2	3	4	5

A minimum score could be decided upon to determine whether or not the objective had been met. As in performance assessments, verbal rating scales can be constructed that describe in verbal terms what the points along the scale represent.

ASSESSING THE ASSESSMENT

Now that an introduction to the variations in assessment techniques for ISSOE objectives has been presented, it is the task of the teacher to construct his/her own tests and test items. It is suggested that the checklist presented below be completed in each case to insure the quality of the instruments developed.

Checklist Use

You must have one check (✓) for questions 1 and 2 and one check in one of question 3 - 6. For each check score 1 point.

For questions 7 - 13, all options must be checked for each applicable question in order for the item or test to be considered a good one. For example, if you have constructed a multiple choice test (question 7) options a-e must be checked. Each check is again, worth 1 point. For your tests to be acceptable they must receive a score of:

6 if they are essay/identification

7 if they are true/false/matching/short answer/ performance

8 if they are multiple choice

Use the handbook for fuller explanations of each of the options listed under each question.

Checklist for Test Construction (check if item applies)

1. Have you decided upon the domain of learning reflected in the major objective? ____

2. Check the one option that is most applicable:

   a. Is the objective within the cognitive domain? (Complete Checklist Question 3) ____

   b. Is the objective within the psychomotor domain? (Complete Checklist Question 4) ____

   c. Is the objective within the perceptual domain? (Complete Checklist Question 5) ____

   d. Is the objective within the affective domain? (Complete Checklist Question 6) ____

3. (See Cognitive Domain, p. 13) The objective can best be measured by a(an):

   a. Multiple Choice Test (Complete Checklist Question 7) ____

   b. True/False Test (Complete Checklist Question 8) ____

   c. Matching Test (Complete Checklist Question 9) ____

   d. Short Answer Test (Complete Checklist Question 10) ____

   e. Essay Test (Complete Checklist Question 11) ____

4. (See Psychomotor and Perceptual Domain, p. 27) The objective can best be measured by a:

   a. Checksheet (Complete Checklist Question 12) ____

   b. Numerical rating scale (Complete Checklist Question 13) ____

   c. Non-numerical rating scale (Complete Checklist Question 14) ____

5. (See Psychomotor and Perceptual domain, p. 32) The objective can best be measured by a:

   a. Visual identification test (Complete Checklist Question 13) ____

   b. Matching Test (Complete Checklist Question 9) ____

   c. Audio or tactile discrimination test (Complete Checklist Question 13) ____

6. (See Affective domain, p. 34) The objective can best be measured by a:

   a. Checklist (Complete Checklist Question 12) ____

   b. Numerical scale (Complete Checklist Question 13) ____

   c. Non-numerical scale (Complete Checklist Question 14) ____

7. Multiple choice items have: (check if applicable)

   a. focus ____

   b. been clearly stated ____

   c. choices with equally plausible chances of being correct ____

   d. been stated positively ____

   e. no extraneous clues ____

8. True/False items have:

   a. been based on facts without exception or need for qualifiers ____

   b. only one statement to be judged ____

   c. been stated briefly ____

   d. no extraneous clues ____

9. Matching items have:

   a. internally related columns ____

   b. clearly stated directions ____

   c. more alternatives than stems ____

   d. relatively brief lists of alternatives and stems ____

10. Short answer/completion items have:

   a. been stated clearly such that one response is plausible ____

   b. only one completion or related multiple completions per item ____

   c. blanks placed at or near the end of the statement ____

   d. no extraneous clues ____

11. Essay questions have:

    a. focus _____

    b. directions explaining point value or estimated time of response for each item _____

    c. a pre-determined "right" answer _____

12. For performance measures, have you:

    a. conducted a job/task analysis? _____

    b. listed all equipment and materials? _____

    c. decided upon steps and/or product qualities to be rated? _____

    d. developed a checklist or rating scale with accompanying criteria for mastery? _____

13. For identification tests, have you:

    a. stated directions clearly? _____

    b. listed a small group of things to be discriminated between? _____

    c. included only options which test the skill described in the objective? _____

Answers to Exercise 1. CLASSIFICATION OF OBJECTIVES (pp. 7-8)

1. PSYCHOMOTOR: installing the pre-fab cabinets is predominantly a "DOING" task, requiring the student to actually install the units.
2. COGNITIVE: this objective tests whether or not the student is able to apply his/her knowledge to a given situation.
3. AFFECTIVE: this objective requires the student to rate him/herself on personal characteristics, but is neither task nor knowledge oriented, and therefore falls in the affective domain.
4. COGNITIVE: although all elements of the psychomotor (working the cash register) and the affective domain (attitudes displayed in role-playing situation) are present, this objective is primarily concerned with the student's ability to apply his/her knowledge and understanding of sales procedures. Although performance is required, the student could also have been asked to write a description of a mock exchange or refund.
5. COGNITIVE: the student must demonstrate, in a written form, his/her knowledge of sales promotion.
6. PSYCHOMOTOR: definitely a doing objective, since a specific product is expected.
7. COGNITIVE: here is another example of applying understanding of concepts to practice. The student's level of knowledge will be evidenced in the construction of the 4 menus.
8. PERCEPTUAL: the student's ability to locate (see) supplies and to accurately determine the weights, a skill requiring visual discrimination, are being tested.
9. COGNITIVE: the student is required to recall the names of vermin and methods of their control.

Answers to Exercise 2. *MATCHING OBJECTIVES AND MEASUREMENTS (pp. 11-12)

1. NO MATCH: the objective describes a working brake system, the item a faulty one. The objective asks the student to remove and replace a specific part, the item to locate difficulty and fix the system.

2. NO MATCH: the content of both the objective and the item appear to match, but the required behaviors are really quite different. The objective asks the student to repair the tire while the item as stated will elicit only the student's knowledge about the procedure and nothing about the ability to actually repair and inflate the leaky tire.

3. MATCH: the objective requires students to categorize foods into the 4 groups; the item presents a list of foods to be categorized.

4. NO MATCH: the objective simply requires the student to compute the new amounts of recipe ingredients, while the item includes preparation as well as computation. Further, the objective does not present the new amounts in writing.

5. MATCH: both the objective and the item require the same behaviors. The conditions match in that samples and tools are supplied; the behaviors match in that written tests are required.

6. NO MATCH: the objective aims to test student's knowledge of capitalization rules when given written material. The item requires transcription. Although capitalization is mentioned in the directions, it is no longer the focus of the measurement. If the objective were changed to include transcribing and students were informed that only capitalization was to be scored, there would be a match.

*For additional exercises on matching objectives to assessments see, R.F. Mager. Measuring Instructional Intent or Got A Match? Belmont, Cal.: Fearon Publishers, 1973.

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